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ABSTRACT

The present study examines interrelations between young children's conceptions of similarity and difference prior to the operational coordination of these relations. A total of 24 preoperational children, 8 each at 3, 4, and 5 years of age, were tested with a classificatory task. Materials included four different geometrical shapes, with four identical objects of each shape. Objects of the same shape were of the same color, while each of the four shapes had its own color. Each child was tested individually and the entire session was videotaped. All 16 objects were presented in a random pile, and the children were asked to make something with the objects. Analysis focused on the way children's spontaneously built constructions exhibited the spatial relations of contact or contact-and-separation combined with the features of uniformity, complete and incomplete alteration, or no apparent pattern. Results indicate that 3-year-old children express relations of similarity and difference in a limited form. Four-year-old children express differences through contact, a previously infrequent form. When this form includes all given objects, it expresses maximum differences. By 5 years of age, when this form includes all given objects, it spatially alternates equal numbers of same objects and different classes. The similarity relation at all three age groups is marked through an infrequent form that expresses consistency in the criteria of predication, although the number of classes or objects included in these constructions differs by age. (Illustrated coding categories are included.) (RH)

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Young children's development of similarity and difference relations*

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The present study examines interrelations of young children's conceptions of similarity and difference prior to the operational coordination of these relations.

Research in classification and seriation has been interpreted to support the notion that in early childhood similarities and differences develop separately and that they do not become coordinated with each other until the end of concrete operations (Piaget, 1941/1965; 1975/1977; Inhelder & Piaget, 1959/1969). In contrast, the present work is based on the philosophical position emphasizing dialectics, which is interpreted here to mean that the construction of similarity relation, even in a limited form, can only be achieved in relation to the construction of some limited difference relation. This position, then, implies that

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there can never be independent developments of similarity and difference relations.

To search for precursors to the operational coordination of similarity and difference relations, I tested children from the early preoperational period with a classificatory task. Twenty-four children were tested, eight each at 3, 4, and 5 years. The materials included four different geometrical shapes, with four identical objects of each shape. Objects of the same shape were of the same color, while each of the four shapes had its own color.

Each child was tested individually and the entire session was videotaped. All 16 objects were presented at once, in a random pile, and the children were asked to make something with the objects. The children then were not instructed to classify or seriate, but were left to their own devices to spontaneously apply their organizational abilities.

The difference in the present instructions to children (i.e., to make something) from previous classificatory research instructions (i.e., where they were asked to place same objects together, or to place objects together that go well together) signals the theoretical position of the present research which

questions the presumed separation of similarity and difference relations. In contrast to these other instructions, the present instructions allow children to either place together same or different objects; and to place objects next to each other or apart. For this reason, the predicate structure of the presented materials provided the possibility of constructing both the relation of resemblance between members of the same class (here, identical objects) and the relation of dissimilarity between members of a different class (here, different objects). This is why there were as many different classes as there were objects in each class.

The children's behavior was recorded as they engaged in making spontaneous constructions and the discovery of the systematic nature of these constructions constitutes the major phase of the analysis. Specifically, I analyzed the way in which children incorporated the predicate structure instantiated by the materials in their spontaneous constructions. For this reason, every attempt a child made, whether successful or not (from the child's point of view), was as informative as the rest. The analysis focused, then, in the way children go about making something, the corrections they make, their slight or gross adjustments as well as their final products.

The minimal requirement for a construction was that at least two objects are brought into contact. In the course of the building process, some constructions were destroyed after they were made; others were remade, using the same objects; and others were left intact on the table, while children went on to make more constructions with other objects. All these constructions were included in the full analyses (see Nicolopoulou, 1984). However, in order to relate the present findings with previous research on classification, which has focused on final products, I will now report only analyses on children's final products, rather than children's entire building process. I want to emphasize that the structure of children's final products can only be adequately interpreted when considered as part of the children's entire building process. This is reflected in the way I analyzed children's final products which is markedly different from previous classificatory research, as I'll point out later.

A final product was defined as the last set of construction(s) that children made. This set was demarcated as the final one by children's behavior. That is, all children indicated either by their posture and/or by saying that they were finished. Then, all the constructions that were on the table constituted the final product.

Children could have made final products as either a single construction (of up to 16 objects) or multiple constructions (of as few as 4 objects, 2 constructions of 2 objects each). If they made a single construction then these children could express their relations of similarity and difference through contact only. However, when they made multiple constructions, then, some objects were in a contact relation while at the same time separated from others. If children made multiple constructions, they could express similarity or difference relations, or -more appropriately- equivalence and nonequivalence relations, through contact and separation.

In the handout you can see the possible predicate categories that each spatial relation (contact or contact-and-separation) could express. When objects were placed in contact only, then this construction can be (a) by uniformity (all identical objects) or (b) by alternation (complete and incomplete) which expresses degrees of difference relation, or (c) by no apparent predicate pattern. When objects were placed in contact while they were also separated from other objects, they can express both equivalence and nonequivalence. They express equivalence when two criteria are met: First, there is consistency in their criterion of predication; that is, they repeat the same predicate

relation of either uniformity, or alternation, or no-pattern. And, second, they also replicate the exact spatial arrangement of equivalent objects. Thus, equivalence can be achieved by (a) the exact replication of uniform constructions, and (b) the exact replication of alternation constructions. Children can express degrees of nonequivalence with multiple constructions when one or both of the above criteria are not met. First, children only repeat the same criterion of predication but not the exact spatial arrangement of equivalent objects. For example, constructions are all by uniformity, or they are all by alternation. And, second, children's constructions even show lack of repetition of the same predicate relation. For example, some constructions are by uniformities and the rest by alternations.

The present analysis of children's final products is different from previous analyses. For instance, one investigator (Denney, 1972b) placed children into one category based on their dominant response. Therefore, not all children's groupings were taken into account and similarity was the only dimension considered in this categorization scheme. On the other hand, Inhelder and Piaget, as followed by a number of other researchers (De Vincenzo & Kelly, 1984; Silverman, Dansky & Laughlin, 1984), categorized children's final constructions through some logical

and spatial criteria. However, they did not carry out independent analyses of logical and spatial relations on children's constructions. Furthermore, they focused only on similarity and contact and not difference or contact-and-separation. In contrast, by including difference and contact-and-separation the present analysis of final products focuses on independent analyses of both logical and spatial relations and observes their developing interaction.

Due to time constraints, I will present a limited analysis of the results. The argument that I have advanced so far is counter to such a practice, as I have argued that we cannot simply single out a certain set of constructions without taking into account the way in which they were achieved. For this reason, the interpretation of the results sometimes goes beyond the data that I'll be presenting in detail.

As you can see in Table 1, in their final products (here, first attempts only) three-year-olds made multiple constructions more frequently, while four- and five-year-olds made single constructions more frequently.

At age three years, both similarity and difference relations were expressed but in a limited form. The most common predicate

category was constructions marked by uniformities. These constructions, made up of identical objects, were always part of multiple constructions. Three-year-olds, however, did not exhaust all identical objects when making constructions marked by uniformities. At most, they made one construction by uniformity that exhausted all its members. The rest of the cases included just a few pairs of the same objects. Thus, the similarity relation is still limited and does not yet constitute a true relation of equivalence.

Considering children's entire building process we found that three-year-olds express the difference relation through spatial separation. Considering only children's final products, the difference relation is expressed by the fact that although most multiple constructions contained some uniform constructions, these uniform constructions occurred with either other uniform constructions (37%), constructions by alternation (25%), or constructions without a pattern (12%).

At four years of age, the difference relation is dominant and is expressed through a new form that places different objects in contact rather than apart, as was the case at age three years. Four-year-olds' first attempts at a final product were more frequently single constructions. When single final products were

generated and children exhausted all 16 objects there was no pattern for four-year-olds. But almost all points of contact were by differences in these no-predicate-pattern constructions, which is highly unlikely by chance alone. When children restricted themselves to a few objects in their single final products that expressed differences, the construction was by incomplete alternation (25%).

The similarity relation at this age group is still restricted to infrequent multiple constructions marked by all uniformities which point towards the establishment of consistency in the criteria of generating a same predicate pattern (here, uniformities). However, the exact same predicate pattern is not yet repeated which would be required to infer the establishment of an equivalence relation.

By age five years, the difference relation is still dominant. It is expressed through single constructions marked by alternation only. For the first time final constructions by alternations were complete which were slightly more frequent (38%) than incomplete ones (25%). This development is important because complete alternations include same and different objects together under a single construction. Same objects were placed next to each other and, in turn, they as a class were placed next

to another class of same objects. Through this regular repeated pattern children achieve the coordination of same and different objects in a single construction. The difference relation is also expressed through a shifting of the criteria of predication. Five-year-olds construct more frequently than other age groups multiple constructions that juxtapose an equal number of uniform and alternation constructions.

At this age, the similarity relation is still restricted in constructions marked all by uniformity which were infrequent (12%). But they still point to the consistency of criteria of predication as seen in four-year-olds' multiple constructions.

In conclusion, focusing on children's final products we see that at three years of age both relations of similarity and difference are expressed but in a limited form. Similarities are expressed by contact and difference by separation. At four years of age, a previously infrequent form emerges, that expresses differences through contact. When this form includes all given objects, it expresses maximum differences. By five years of age, when this form includes all given objects, it spatially alternates equal numbers of same objects and different classes. On the other hand, similarity relation at all three age groups is marked through an infrequent form that expresses consistency in

the criteria of predication, although the number of classes or objects included in these constructions differs by age.

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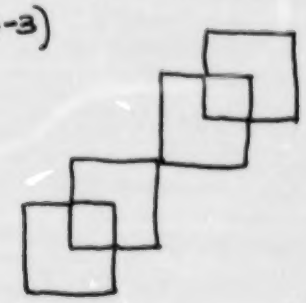
Young children's development of similarity and difference relations

Coding categories

I. Predicate categories of individual constructions (contact)

1) Uniformity: in these constructions, children used a single criterion of predication (e.g., identical objects).

JF(4-3)

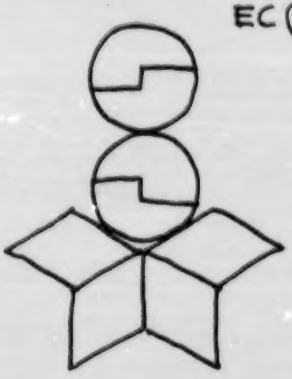


AV(5-1)

2) Complete alternation: in these constructions, children alternated between criteria in making them, and there was an equal number of contacting objects for each criterion.

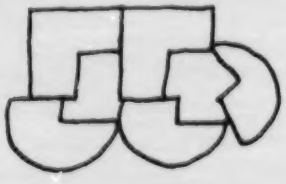
EJB(3-3)

EC(5-1)

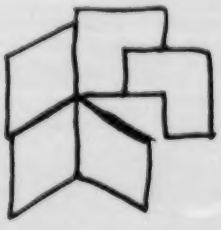


3) Incomplete alternation: differs from complete alternation in that the number of objects included according to each criterion were unequal.

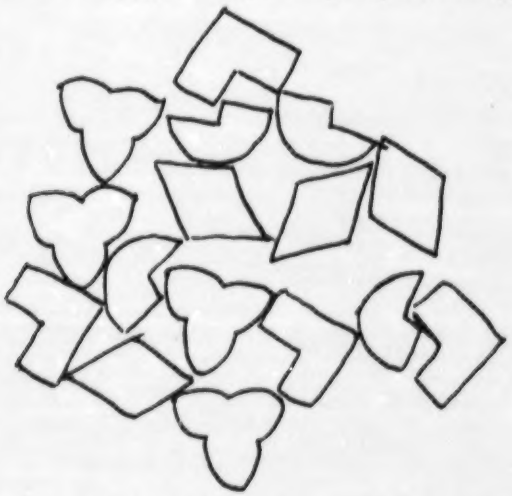
AV(5-1)



JFG (4-4)

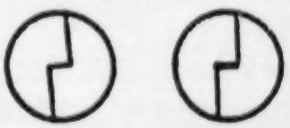


4) No pattern: there was no apparent predicate pattern observed in these constructions.

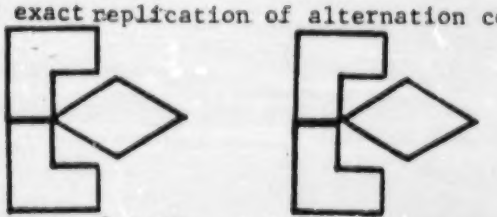


II. Predicate categories (equivalences and nonequivalences) of spatiotemporally overlapping constructions (separation).

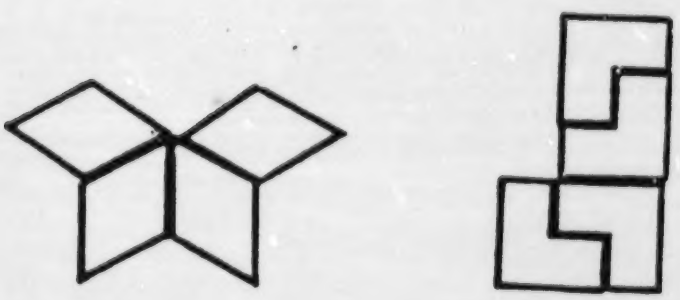
1) Equivalences: (a) by exact replication of uniform constructions.



(b) by exact replication of alternation constructions.

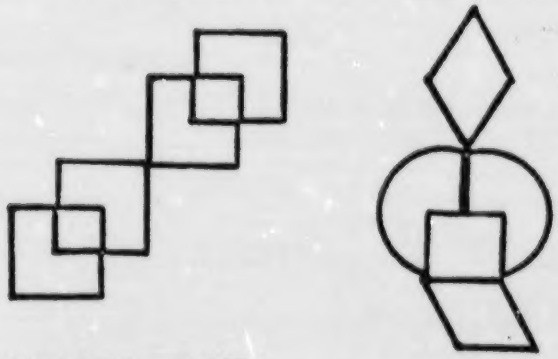


2) Nonequivalences: (a) by uniformities; children repeat a construction by uniformity but the exact same predicate property is not the same.



(b) by alternations; children can repeat constructions by alternations but the exact predicate relation of alternation is not replicated between them.

(c) by mixed criteria; mixture of uniformities and alternations.



(i) uniform. > 75%
(ii) altern. > 75%
(iii) uniform. + altern. (50% each)
(iv) mixed (e.g., uniform. + no pattern).

Table 1

Mean percentages of predicate categories for first attempts at a final product

			Age		
			3;00	4;00	5;00
Single		Uniformity	-	12.5% (1)	-
		Complete Alternation	-	-	37.5% (3)
		Incomplete Alternation	12.5% (1)	25.0% (2)	25.0% (2)
		No Pattern	12.5% (1)	25.0% (2)	-
Multiple Constructions	Equival. (replicas)	Uniformity	12.5% (1)	-	-
		Alternation	-		
	Non Equival.	All Uniform.	12.5% (1)	12.5% (1)	12.5% (1)
		All Altrn.	-	-	-
		Unif > Altrn	12.5% (1)	-	-
		Unif < Altrn	-	-	-
		Unif + Altrn	12.5% (1)	12.5% (1)	25.0% (2)
		Mixed	25.0% (2)	12.5% (1)	-

* Numbers in parentheses indicate the number of final products